

AN INVESTIGATION OF PROCEDURE AND TECHNIQUES
INVOLVED IN GRAPHIC REPRESENTATION

by

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INTRODUCTION

The field of graphics has been the architect's basic means of expression since the dawn of the profession. Prior to the development of perspective drawing in the fifteenth century, man had no positive way in which he could express the development of an architectonic form preceeding its actual construction; consequently, the early architect could only envisage his design by means of scaled two dimensional drawings of elevations and floor plans. Perhaps, in many instances, scale models were constructed, but a survey of architectural history has shown that many buildings were simply designed as their construction progressed. However, as society changes in the course of history--so must economy; and in this ensuing economical development, the architect-client relationship also underwent drastic changes. The architect is no longer retained by a wealthy patron to design and construct his buildings regardless of cost or time consumed. The architect of today is now commissioned by a client who considers the factor of time consumed in the preparation of designs a very important aspect of the over-all program. The client of today, prior to the actual acceptance of the building or buildings as a project, must, through means of drawings, interpret the ultimate scheme, and pass or reject it as proposed. The architect may discuss the qualities of a design convincingly, but his basic means of communication must be through various

drawings of the building. Following the client's acceptance, the architect interprets his intentions by means of drawings of various details of the building in order that the builder or contractor may comprehensively understand the desired method of construction. Therefore, from the beginning stage of actual conception of the building through the completion of the actual building, the architect has relied almost completely upon his ability to convey his ideas which he has envisaged within his mind by means of graphic expression through the use of lines, texture, pattern, masses, and forms on a two dimensional surface. This was man's earliest means of expression as found by Luzadder.

From the earliest times pictorial representations have been the means of conveying the ideas of one person to another person and of one group to another group. There is little doubt that our ancestors traced out in the dust of the cave floor many crude pictures to supplement their guttural utterances. On their cave walls these same primitive men and women drew pictures which today convey to others the stories of their lives. They used the only permanent means they were aware of at that time. (Luzadder, 15), p. 221.

Through the association of words and their meanings, the architect could express his intentions, but this method of communication was extremely limited in its application to the expression of a particular form such as a building--this type of expression involved many different connotations.

.....In his professional creative work a designer is concerned with a world of vision and of the other senses, more than with one

of talk. His basic "language", so to speak, is visual more often than verbal. (Newton, 20), p. 9.

And even if in our talk we designers wisely restrain any over-use of high-order verbal abstractions of a fictive type, even if verbally we stick to levels relatively close to originally first order facts, it remains true that the words we use are still considerably removed from the events they are meant to symbolize. This matters especially in the creative phase of our designing, where we are engaged in the study of specific form. Suppose we are studying the design of a simple piece of furniture, such as a chair. If I say the word "chair", I suspect that each person will visualize a different chair. But if I show a drawing of a chair, I have a hunch we shall be at least nearer to agreement as to exactly which nonverbal chair I am referring to. Our area of agreement will be broader, and our ensuing discussion about the design of the chair will be more profitable. (Newton, 20), p. 25.

Therefore, due to their limited descriptive powers, written and verbal transmissions have proven inadequate as the sole means of fictive expression, and must be supplemented by graphic representation.

The architect unfortunately could not construct a prototype of his intended building. His prototype existed only within his mind, and in order to project this creation into reality, he represented the image graphically so that others might interpret it. The final design of his building, therefore, was dependent upon two things.

1. The architect's ability to create--this grew from a sound interpretation of the fundamentals of basic

design gained by study, research, and observation. It was regulated by thought and stimulated by intuition or perception of specific principles.

2. The architect's ability to express these ideas, and transmit them so that others might comprehend his intentions. A well conceived architectural design is not a reality until it has been constructed and serves the people for whom it is intended. The transitional nature of graphics between the conception and the actuality requires that it be given the utmost study.

"Graphical expression" produces an image of the conception, and thereby serves to convey the ideas of the architect to those who help to produce the actual building. This purpose--so important in the conveyance of an idea--illustrates the need for the proper mastery of its techniques.

The two phases involved in the creation of architecture; the development of the design, and the expression of this design, were the subject of this investigation. The process of teaching this approach was one of guidance and encouragement toward creative endeavors. Thought processes were controlled by a sound knowledge of the fundamentals of good design.

Design, of course, cannot be taught. All that an architect in charge of the design done in a school can do is to encourage an orderly mental process in the solution of problems, and when a student is found with something to say in the hypothetical building material of imaginary structure, to help him say it. (Nobbs, 21), p.4.

This was predicated by the postulation that good design is not simply a matter of "taste", but rather a matter of carefully organized analysis.

There is a logic underlying all study, whether it be art, or music or architecture, or craft, or planting corn. It is this logic which is teachable; without this logic the student flounders along in mere guess work, in a mire of technical obstructions, until he becomes weary and disconsolate. (Carlson, 3), p. 28-29.

This approach to design with its related interdependence between the thought process and the graphic expression of its results was merely an approach to the teaching of basic architectural design, and was not, by any means, considered the only approach. However, it has been the observation of the writer in taking a retrospective view of various other methods of approach, that too many were taught as independent courses; thus, making it quite difficult for the student to grasp the true dependence of each upon the other. Teachers have often seen the results of overemphasis on one course with the neglect of the other. This improper balance is illustrated by the student who could talk "good design", but never seemed to be able to present these "good ideas", and the student, in turn, who presented a magnificent presentation of a very poor architectural design. Robinson found the essentials of development in any art to be all-encompassing.

Again, a craft is readily taught, whereas an art may not be taught directly since its character is more or less intangible. Instruction in an art is essentially indirect and consists of three things:

1. The development of discrimination, good judgement and good taste.
2. The presentation of various techniques for the production of skill in the transmission of ideas.
3. The creation of a memory content of the work of the past and the present derived from reading and study, from observation, and from travel.
(Robinson, 24), p. 5.

THE CREATIVE APPROACH

It is perhaps more difficult to direct and instill a creative approach in architecture than in any of the related arts. The artist creates on a two dimensional surface. He may create the illusion of a third dimension, perhaps, by means of perspective or by the clever use of colors. The sculptor creates three dimensional objects at a scale which is small enough to enable him to do the actual execution in three dimensions. The architect, however, thinks in terms of three dimensions, but: (1) He must represent his creation on a two-dimensional surface. (2) The size limitations of the working surface demands that he interpolate and present his scheme at a much smaller scale than the actual result--although he must think in terms of the actual size of the building and

its relational scale to the human being. Due to the complex nature of this process, the problems were given in an orderly sequence which would allow for gradual visualization development until the automatic registration of ideas in three dimensions, in their proper environment and actual scale, became part of a routine discipline.

In the initial stages of creative development, background factors relating to each type of design were given. These became more complex in the nature of their demands upon design as the problems progressed.

Creative work may come about by that agency called imagination as a result of having all the background factors well in mind. (Bowman, 29), p. 6.

Consequently, as problems became more difficult, their solutions demanded more complicated research, evaluation, and synthesis. However, the actual pattern of procedure remained fixed.

This whole process of architectural design is one of evolution or the process of development and growth. (Bowman, 29), p. 10.

The creative process was looked upon as a means of discovering new potentials within the realm of available materials and the scope of the problem. Interpretations were encouraged, and evaluations were diagnosed to promote confidence in self-judgement.

Our thinking mind is mainly two-fold:
(1) a judicial mind which analyzes, compares

and chooses. (2) a creative mind which visualizes, forseees, and generates ideas. Judgement can help keep imagination on the track, and imagination can help enlighten judgement. (Osborn, 23), p. 93.

GRAPHICAL EXPRESSION IN BASIC DESIGN

Abstract Composition

Good architecture, with all of its complexities, is achieved by means of a thorough knowledge of "design". Architectural design is the integration of technological, social and economic requirements, biological necessities and the psychological effects of materials, color, volume and space arranged and organized into pleasing relationships specifically for MAN. This knowledge encompasses both the physical and the psychological aspects. However, it was felt that the first stage of development should be one in which the encumbrances of physical factors were somewhat complex and should not be introduced until a feeling for abstract design had been grasped.

Deep within everyone of us lies an appreciation for visual beauty. We seek beauty and orderliness. We avoid ugliness and disorder whenever possible. Our enjoyment of beauty is instinctive, based on an emotional response that authorities call aesthetic appreciation.

This emotion is not a superficial feeling to be derided or ignored, but a worthwhile experience that all of us share, although we often disagree on individual examples of beauty. The presence of beauty, it should be recognized, is a biological necessity, important to the happiness

and welfare of all mankind. As this idea receives the increased attention it deserves, we will be able to plan a new, more satisfying way of living in better organized, more beautiful surroundings. It will provide us with utensils, tools, furniture, homes, schools, factories and cities that are more beautiful and efficient. (Styling, The Look of Things, 26), p. 5.

The basic experiments in the design experience were concerned with the development of perceptual capacities, recognition of the value of aesthetic qualities, and an investigation of the potentialities of design expression.

The aesthetic qualities of good arrangement, i.e., "order", were investigated through experiments with simple compositions. The basic symbols of design (line, plane, form, and surface quality) were introduced by relating them in two-dimensional compositions.

As with any means of communication, the art of design has its own language--sometimes called the language of vision.

This special language has only four basic symbols: line, plane, form, and surface quality (which includes value, color and texture).

Any visual organization or design, regardless of how complicated or spectacular, is the result of blending these four visual ingredients. (Styling. The Look of Things, 26), p. 15.

It soon became evident that design expression was mainly a problem concerned with the achievement of the best possible relationships with the design elements---these relationships, in turn, governed by the functional aspects of the design and the materials at hand.

In art matters we are not dealing with rights or wrongs, either moral, physical, or mental. A problem in art is not like a mathematical problem with one and only one "right" answer. We work with nothing more absolute than choices between the better and the less good. (Smith, 25), p. 30.

It was found that the creative value of a simple composition lies in its use in gaining a comprehensive insight into the value of sharpening the perceptual capacities through constant analysis of the constructed areas (positive) and the spaces around the constructed areas (negative).

The quality of architecture lies not only in the sure mastering of diversified elements, but in the harmonious order that is established between them. Hilberseimer, 12), p. 12.

Constant emphasis was placed upon the arrangement of these symbols with the purpose of striving for unity--to make all of the parts work together so well that nothing could be changed without disturbing the unity or balance of the composition.

To achieve unity in anything we make, we play with the adjustment of its parts to each other, attempting to create felt relationships that will act as bonds between them. We seek symmetry and balance among them, accenting some and suppressing others, reducing their apparent number by simplification, and creating resemblances to form between those that must remain distinct; we draw their lines so that they flow into one another as the lines of the human body are blended (Teague, 27), p. 105.

The abstract analysis and its relationship to architectural design was accomplished by means of the comparative usage of the

design symbols (line, plane, form, and surface quality) with existing architectural designs. Observations were made in regard to the influence of these symbols in the total effect achieved. The basic principles of abstract design were evident in all examples of good architecture.

Though the old academic principle of bilateral symmetry has been replaced in modern composition by a free balance of parts. Modern architecture does not reject the use of an abstract, geometrical discipline in plan or facade. Compositions on a large scale seem to demand a certain type of geometrical order that cannot be explained by simple interpretation of function. An important psychological factor of satisfaction and comfort lies in knowing what to expect from the whole by what one has experienced in the parts already seen. Regularity between certain elements of composition can aid in creating that unity which may be established only through a sensation of order. (Nowiki, 22), p. 406.

The qualities of emotional expression were explored in relation to simple composition. These were found to be useful in the expression of a particular feeling in the design of a building, and in the expression of the presentation of the building.

A satisfactory design is dynamic. We find within it movements that are expressed in line, in color, in forms, or in gradation of tones... Some of these movements are parallel; some oppose each other.... One main direction, however, becomes dominant. Between the opposing forces there is felt, ultimately, a moment of balance so that these forces are contained within the design. (Emerson, 7), p. 108.

The potentialities of expression were found to be innumerable. The mastery of this, of course, depended upon the skill

with which the symbol was rendered, but the potential of expression existed within the understanding of its fundamental nature.

Lines in Two Dimension

The purpose of the introduction of lines in composition was to explore the complete potentials--to understand what lines really are and what they can do for one as a designer. It was found that the study of lines is truly the verification of the premise, that in the creative process there is a very close relationship existing with regard to the created image and the expression of that image. If the inherent qualities of line are understood, then one has a symbol which is capable of expressing what-ever feeling one desires.

When we speak of good lines in a beautiful object, we recognize the importance of this design element in the visual organization.

Lines not only help define and give shape to the object, but have another purpose as well. Nature causes the human eye, when inspecting a design, to skip about from one point of interest to another. Properly conceived lines lead the wandering eye back and forth across the design, adding to the interest and retaining attention. Thought of in this light, lines might be called reading aids in the sense that the eye is said to read a design. (Styling, The Look of Things, 26), p. 16.

The first observation was that line, being the path of a point moving through space, has movement. This movement is closely associated with the direction of the line, the length

of the line, the variation in width of line, and the proximity of one line to another. Through the manipulation of these various psychological aspects associated with line, it became possible to move the observer's eye from one point of the composition to another, thus making it possible to control the spaces within a composition and to pull them together.

By definition a line is the path of a point moving through space. It has only one dimension and direction is its most important property. A line carefully drawn and controlled according to some definite plan marks the beginning of visual organization, of good design.From a practical standpoint lines are an important connecting link between mental image and the actual desired physical shape. (Styling, *The Look of Things*, 26), p. 16.

Curved lines seemed to move much slower than straight lines. Horizontal lines signified repose, while vertical lines showed dignity. By understanding the relative movements associated with line, one is capable of enriching his architectural design vocabulary. Thus, making it possible for the designer to focus an individual's attention upon any desired point.

The moment a line is drawn it divides the surface upon which it appears. Thus, in reality, there can be no absolute isolation of any element. The beholder cannot refrain from seeing line on its background as Shape-divided-by-Line, or of thinking of line as path of movement, if it does not appear to serve as edge or boundary Line hardly ever appears in nature but is almost exclusively a man-made device, a sort of short hand sign which indicates in a drawing where one thing ends and another begins.

One may secure either positive or negative effects in the use of any of the art elements, according to their relationships and associations. Heavy, straight, vertical lines, rather closely set, may seem rigid and bigoted. Unorganized variations of slant lines look nerveous. Unrelieved horizontals seem monotonous and even dead. Curves are gentler than straight lines, with connotations of grace or suaveness or charm. The curve's change of speed adds a dynamic ease. But wobbly, indecisive curves bring in negative suggestions. The curve which springs vigorously but with smooth transition from a straight or nearly straight line has youth in it. Full, falling curves look decadent. (Smith, 25), p. 21.

The designer may not only express movement by the use of line, but he may also express certain moods, and create static or dynamic impressions by varying the width of lines within a design (Plate I).

If all the lines in a design are moving with the same rhythm, they show Unity. They express one mood.

But if the design is to be interesting, the lines should not all be alike. They should differ in length, width, and dark and light, and in the particular quality given by the way the crayon is held--by the relation of hand and tool.

Thus lines show Variety too. The idea that unity and variety are of prime importance in a design is not a new one. It has been understood by all designers.

In the best designs some lines will hold our attention because they seem more important than others. They are Dominant. (Emerson, 7), pp. 14-17.

Lines may also define shapes and express form, this was found to be particularly invaluable in the graphical expression

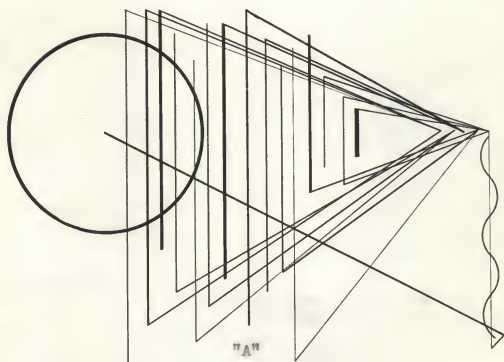
EXPLANATION OF PLATE I

Lines in Abstract Compositions.

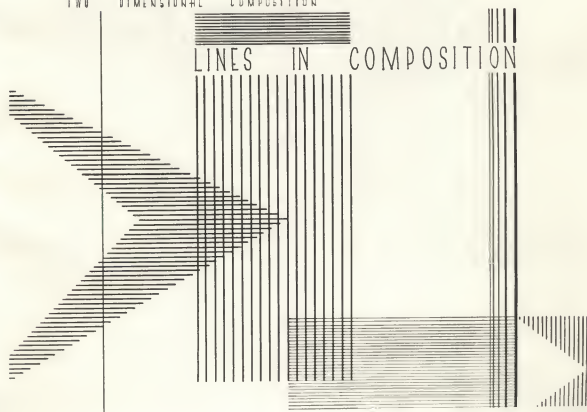
- A. Variety in width and direction of lines illustrate confusion or busyness.
- B. Arrow-like projection has directional movement due to variation in length and rhythm-like proximity of lines.

Vertical and horizontal lines give directional movement because of proximity.

PLATE I



TWO DIMENSIONAL COMPOSITION



"B"

of imagined designs. Various materials, patterns, textures, areas, planes, and volumes may be expressed in architectural design by means of line. The more one understands the qualities of line, the more one is capable of coherent architectural expression.

Lines in Space (Planes)

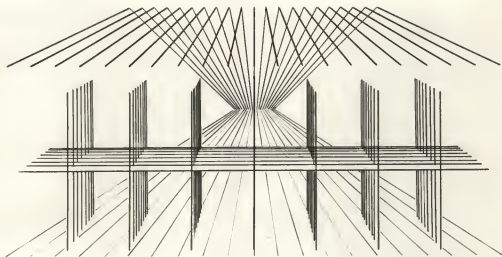
This was the first introduction into the recognition of the third dimension which plays such a vital part in architecture. By the manipulation of lines and planes in space it was possible to explore the potential of lines and planes when presented so that they suddenly seemed to recede into space (Plate II). The frequency, or proximity of spacing, of lines is the determinant as to whether the series is visually interpreted as the development of a plane or even a form, or whether it remains a grouping of isolated lines articulating elements and spaces. This knowledge was of the utmost importance in its architectural application in the study of the modular subdivision of exterior walls in elevation.

The relationship of line to plane is also important in the graphical expression and design of spaces in architecture, for again, the walls, ceiling, and floors of a building were found to be merely planes intersecting one another. As expressed graphically, line may represent plane, define mass, or simply circumscribe two-dimensional shapes--the designer must

EXPLANATION OF PLATE II

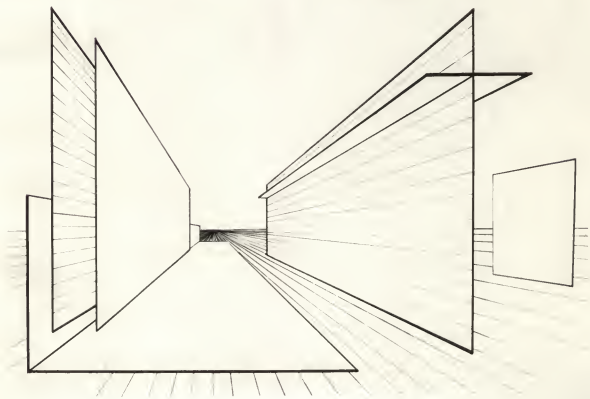
Abstract compositions projecting
lines and planes into space.

PLATE II



L I N E S I N S P A C E

L I N E S I N S P A C E



always be conscious of the analysis intended when working with lines on a two dimensional surface.

By conventional definition, a plane is a flat, level surface which has only two dimensions, length and width, and is without thickness. The entire study of plane geometry is devoted to the plane and to the properties and relations of such plane shapes as the circle, square, and triangle.

Since the human eye tends to slide over plane surfaces seeking points of interest, the outline or shape of a plane is one of its most important characteristics. A plane, like a line, may also have the property of direction, a fact which has been receiving considerable attention from architects in recent years.

The architect uses planes to divide living space, not in the formal sense of plaster-enclosed rooms, but as design elements which give depth, interest and flexibility to the interior. (Styling, The Look of Things, 26), p. 17.

Textures

Designers should cultivate a feeling for the nature of materials and a technique for the representation of various textures and patterns, in order to graphically translate them into abstract terms in his architectural presentation. This develops an acquaintanceship with the materials with which an architect works, and also stimulates an aesthetic appreciation for them. It creates consciousness for the scale of certain textures or patterns in relation to others which might be used in direct association with them.

If a certain texture is contemplated in the final design, then the inherent qualities of the material must be investigated in order to represent the material as closely as possible.

Texture is a surface quality that results from the manner in which a material is constructed.

In combining textures we are careful to separate those which are alike in scale or tone so that they will not seem to intermingle but each will keep its own identity. (Emerson, 7), p. 74.

The ultimate scale of textures can be interpreted two ways:

1. By their relational size with known objects.
2. The relational expression between the graphic translationship and the representation of the actual material.

Exercises employing lines and textures in simple composition were utilized as a means of achieving harmonious designs and patterns (Plate III).

Design establishes the proportion of parts to the whole or to each other, arranges for balance or symmetry, disposes them to produce a sense of rhythm or candenced spacing and creates a pattern. (Robinson, 24), p. 59.

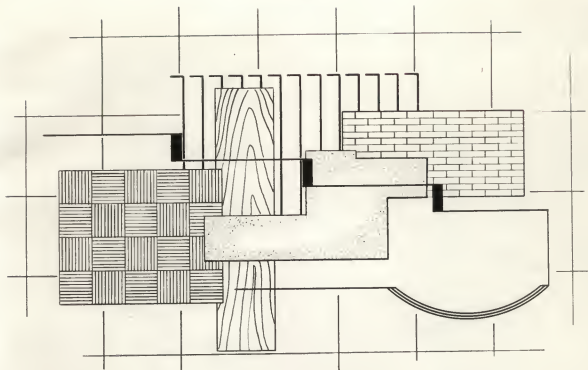
Shapes and Masses

In the composition of shapes and masses, an evaluation of the inherent characteristics of basic shapes was considered of the utmost importance. It was noted that the circle, the

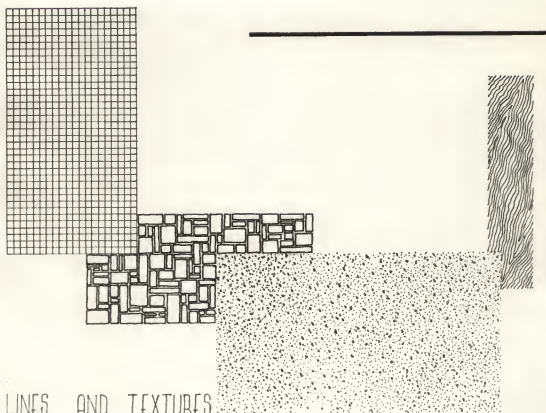
EXPLANATION OF PLATE III

Lines and textures in abstract
compositions.

PLATE III



L I N E S A N D T E X T U R E S



L I N E S A N D T E X T U R E S

square, the free form, and the equilateral triangle were shapes which intimated repose and suggested static qualities; whereas, other shapes generally expressed a certain amount of movement, and added an indubitable amount of dynamic quality to the design. By understanding the characteristics of the basic shapes, it became less difficult to arrange them in pleasing compositions.

One principle advantage of the arrangement of masses was in its development of perceptual capacities. The pleasant abstract arrangements were those in which both the masses and their surrounding spaces were taken into consideration.

A design is apprehended through movements of the eye over its various parts. The enclosing shape or space is always considered as part of the design.

The movements or tension between the various parts of a design are caused by many relationships. Some of which are the following:

Proximity of certain parts: Those near each other may seem to belong together.

Similarity of parts: Resemblances call attention to similar parts and seem to draw them together. (Emerson, 7), p. 101.

The satisfactory arrangement of masses consisted of the establishment of pleasing relationships. In the composition of masses the following must be taken into consideration:

1. Relationship through proximity.
2. Relationship through size.
3. Relationship through shape.

Always the aim of design is Harmony. Keeping such a proper sequence of study in mind, we may proceed to the abstract study of mass and form. In this, we begin with few and simple outlines, the more abstract the better, and from these we build up a mental perception of depth and distance, of opposition and balance, of scale and proportion, of sequence and time, of climax and interest. First studies are best made in the abstract and the simplest possible terms. (Robinson, 24), p. 65.

The problem of balance, in which the occult (assymetric) balance must be considered becomes quite evident when working with masses, and this was proven invaluable in the development of design organization (Plate IV).

In the visual arts there are two main kinds of balance, symmetrical and occult. The first places its parts or accents evenly on either side of a center point or axis. This type of balance may be two-sided or many-sided. Each of its repeated parts must duplicate the others, however. It may be somewhat mechanical in its effect or, at least, easily measured. The effect is often static. Symmetry is usually dignified and is easily comprehensible.

Occult balance is more subtle. Its effect is dynamic. In occult balance, unlike parts are arranged about a balancing point or axis, and they hold the total in equilibrium by their "pull", their fields of attraction, and their visual tension. Such balance is not easily measurable mechanically. But to the sensitive mind experienced in judging this kind of balance it is no less clear, when successful, than is symmetry. Anyone can learn to perceive the lack of balance when an occult arrangement is out of poise. (Smith, 25), p. 36.

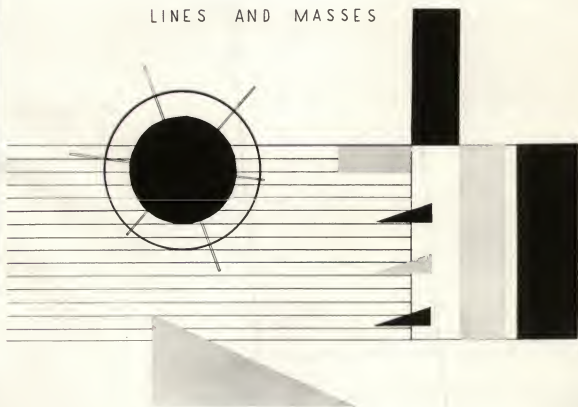
EXPLANATION OF PLATE IV

Lines and masses in abstract
compositions.



LINES AND MASSES

LINES AND MASSES



GRAPHICAL EXPRESSION IN ARCHITECTURAL DESIGN

Entourage Expression

Following an examination of the qualities of line, plane, texture and mass and their relation to architecture, came an investigation of the means of presentation of the supplemental elements related to building. These are the qualities which give scale and realism to an architectural delineation. These elements aid in representing a building in its natural surroundings. They help give the building its indigenous personality--for a building without trees, people, shrubs, and the other elements of its natural environment has no feeling of belonging.

Every building, as is well known, is different for two basic reasons:

1. Its functional interpretation requires that its spaces and volumes be related to the physical needs of the people whom it must serve.
2. Its environmental influences such as terrain, natural growth, other buildings, etc., require that its physical and aesthetic concepts be adaptable.

Consequently, it was found that every building was greatly dependent upon its site and the interpretation of the mental image must be a presentation which takes the entourage elements of architecture into consideration. If these are not shown, then the presentation is simply one of a building in space--it has

no geographical location and consequently no indigenous qualities. Also, without these supplemental representations with which we have a direct association of scale; the building has no scale value to the observer.

This investigation of the techniques of entourage expression was also beneficial in the interpretations of the qualities of line, plane, texture, and mass (or form). In working with these factors, it was found that variations of surface quality, pattern, and form could be expressed with definite similarity to the actual object. It was noted that many interpretations of objects such as trees, hedges, shrubs, etc., could be expressed almost symbolically and still attain the intended results (Plate V).

Man

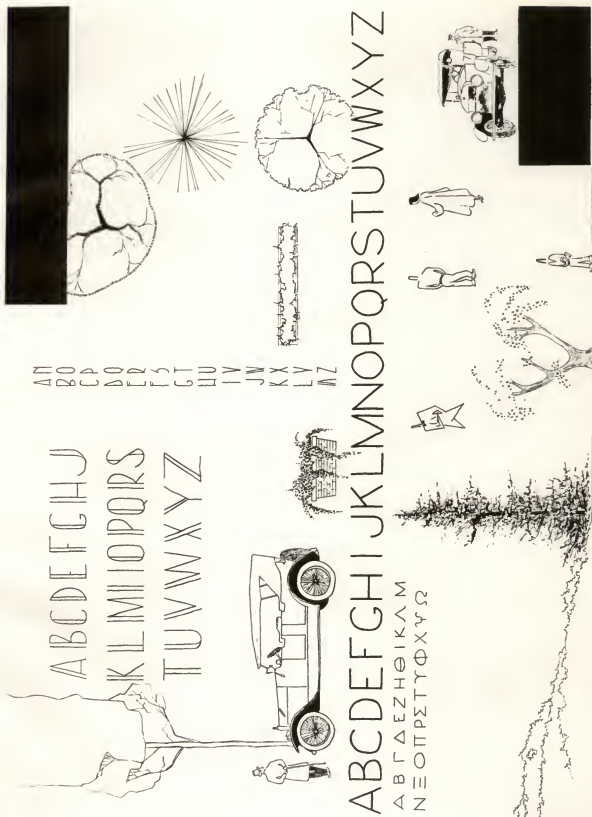
The sequent analysis of abstract design was the investigation of man and his environment. This was the first introduction to three dimensional architectural design. The process of thinking in terms of three dimensions was cultivated by means of a gradual approach. Models of buildings were examined and interpreted in regard to their physical and aesthetic qualities. The inherent qualities of the building, it was found were dictated by the physical and psychological needs of man, and the relationships of the buildings to their sites.

The most important single investigation was that of man.

EXPLANATION OF PLATE V

The expression of entourage.

PLATE V



The new architecture will be focused on the human being, at least we may so hope. Less grandiose but more lived in, less pretentious but more honest, the architecture of the future will turn from glorifying gods and big business and express more intimately the life and the needs of men as they are. (Brownell and Wright, 2), p. 183.

The nature of man, when understood, has guided the architectural solutions intended for man's use. The existence of the architect has been completely dependent upon the basic need of man for shelter. In fact, the relationship between man and his shelter has been so closely associated that it is possible to interpret his past societies by the study of his buildings.

Buildings are transmitters of life. They transmit the lives of the past into the lives of the future--if they are more than mere shelter and mass than borrowed form. A people without architecture transmit little of its culture. Each phase of its history ends with the death of the generation that created it. (Moholy-Nagy, 17), p. 19.

The advancement of technological means has given us an even greater potential for expressing space and form in its adaptation to the needs of people--to their shape, their size, the way in which they move about and relax, their requirements as to the air, sun, shade, the way they perceive their surroundings, etc. This interpretation of architecture in relation to humanism has given us a dynamic architecture which is bent upon fulfilling every requirement of man's need for shelter.

Humanism may well be considered the main principle of the new movement. Even though

functionalism was its official title. Man and his way of life became the main source of inspiration to a modern architect. Forgotten in the esthetic speculations of the nineteenth century, man, in the basic sense of individual and social character, again became the object of creative attention. Many presented two aspects. The first was the unchanging quality of the human individual: The size of his body, the length of his step and the speed of his walk--the same throughout ages--determine the unchanging factors of scale in architect; his basic emotions, though changing in form of expression, are as old as the race itself. The second aspect deals with the constant change in human life and the differences that exist not only between generations but between men of different decades. Now this change is rapid and conspicuous, and it demands constant changes in architectural forms. (Nowicki, 22), p. 405.

Research in this phase dealt with the physical, psychological, mental, spiritual, and social aspects of man as related to the problem under consideration. It necessitated an investigation of life and its problems. For the basic task of the architect, the task which distinguishes him from the engineer and the contractor, is that of sheltering man, his work, and his possessions, in structures that provide spiritual as well as material gratifications.

Architecture has ceased to be the concern of passive and business like specialists who build precisely what their clients bargain for. Architecture has cast off this passivity; it has gained the courage to deal actively with vital questions, inquiring into the needs of the child, the woman, and the man. It asks "what kind of life are you leading; Are we responsible for the conditions you have to put up with? How must we plan--not just in

the case of houses, but clear through to regional areas--so that you may have a life worthy of the name."

When we go to the bottom of questions like these, we see that contemporary architecture takes its start in a moral problem. (Fiedion, 9), p. 494.

The investigation of physical factors constituted research into such factors as man's dimensions, posture, stride, motion/speed, sight-lines, etc. These were found to be component parts of man's physical criteria around which his functional requirements are substantiated. The physical functions are as numerous as there are problems and few of them are exactly alike. However, the functional aspects of a building generally classified themselves under the headings: Circulation, Sound, Sight, Physical Comfort, Protection, Size (area, shape, height, etc.), Equipment, and Service.

Architecture directs the movements and actions of man for the most part from his birth to death, and the designer's decisions will influence the actions of the individual during most of every day. In the consideration of physical function, it was difficult to completely disregard the psychological. However, it was felt this to be natural and preferable. This awareness of their interdependence led the student into the psychological analysis of the problem with ease.

The arrangement of spaces and volumes with regard to the physical requirements was approached through the analysis of the physical zones which occur within each problem.

The overall interpretation was discussed with regard to the complete scope of physical zoning. The zoning of cities, for instance, into recreational, business, industrial, and residential zones--down to the zoning of the residence with its zones for sleeping, cooking, relaxing, bathing, eating, etc.

The analysis of psychological function was approached with the recognition that man is a psychological social, spiritual, thinking being and requires recognition of these qualities in his environment.

Since we are seeking to serve the WHOLE MAN in the fullness of his human potential, the psychological factor thus reveals itself as one of the most fundamental sustaining values with which we must be concerned. For if our experience has proved anything at all about people. It has shown beyond a doubt that human needs--as against those of animals--are not physical and physiological alone, but that they are to a profound degree psychological as well. A man's well-being and happiness do not arise from the mere mechanical adequacy of his environment; he responds to, and can be greatly aided by, his perception of the sight, the sound, the smell, and the feel of what surrounds him. The need for considering this factor we designers recognize--not as an occasional matter of additive luxury, but as an ever-present one of completely integrated psychological necessity in all wholly human problems.

With the full support of scientific evidence, then, we accept this factor as imposing a psychological requirement, which must be met as surely and soundly as the mechanical and physiological requirements if the men and women and children we serve are to enjoy the splendid richness of human living. (Newton, 20), pp. 107-108.

The expression of abstract feeling in space, scale, character, material, color, texture, form, and movement is the problem confronting the designer. There were three steps which were used in going from the abstract feeling to the architectural expression of that feeling:

1. Reduction of major functions to fundamental feelings.
2. Development of fundamental feelings into the expression of that feeling that will in turn satisfy or cause the feeling.
3. The architectural elements that satisfy that feeling and will in turn produce it.

It was felt that through an awareness of the effect of the emotions of design that certain personal qualities of warmth and charm which give certain styles of the past their characteristic acceptance could be retained as an integral part of contemporary architectonic expression.

Architecture for habitation, perhaps more than any other, is a highly realistic, immense, and inexhaustible art. But--the thought recurs--it is not an abstract art far from life, which idolizes material, "interesting construction", or "pure form", glass cubes and other geometricities, or again manipulates with shadows, light and color and assembles these into an external inorganically conceived production per se. Here it is evident that our art has to deal most responsibly with the human "sensible", the sensorial as well as the mental. A fabric into which these manifold yards are woven--in short, with the happenings of our inner life or, what one used to call simply, the soul. (Neutra, 18), p. 314.

Environment

Closely paralleling the investigation of man in relation to the properties which govern architectural design were those of environmental influences. Because the two worked so closely together, they were studied and discussed concurrently.

The world we live in is composed of Man and Nature. Man, himself natural, has emerged from Nature to achieve separate and equal status (good and/or bad) in our philosophies. Man plus man equals the social pattern; man plus nature equals the physical pattern; the social pattern plus the physical pattern equals the world we live in. (Eckbo, 5), p. 29.

However, for the purpose of clarification, they were evaluated separately in this investigation.

The analysis of environment evolved from the postulation that every building has a specific location. The design of the building is therefore, based upon the consideration of the site as well as the people and their needs. This resultant synthesis along with the consideration of the materials and the means of building are the attendant factors from which a certain homogeneity in architecture springs.

The establishment of relations between man and nature in actuality usually involves relations between buildings or structures and the landscape. (Eckbo, 5), p. 48.

The environmental factors of the site control, to a degree, the orientation and the arrangement of spaces within the building as well as the development of the form.

The character of the site--the slope of the land and the

shape of the property along with the relational elements such as roads and utilities, the location and character of adjacent buildings, the type, size, and location of existing natural growth such as trees and shrubs, and the advantageous use of view, were all factors pertaining to the site which should be considered.

Look where the sun rises and sets. We all depend on radiation penetrating into the interiors of our cubby holes, but we also can get too much of it. Watch from where the wind blows and ask long-resident neighbors about it. Flowing air is better than the biggest storage of it. We also must worry about weathering and tightening our shelter at will.

See what you can see from the place, and in what direction. Our eyes relax and rejoice in sweeping over distant vistas. Eyes may get used to a disordered vicinity, always close-up, but we keep on suffering just the same, subconsciously. Overhead supply wires, telephone poles, looming or unsightly neighboring structures are the greatest offenders. Think at once of screening your little visual empire. Calculate the possibility of "planting out of sight" what you do not want to see.

Trees are wonderful--even though they may drop leaves or seeds and give you the chore of tidying up the place. But who would want to forfeit his teeth, just to avoid brushing them? If there are trees granted you by fate, can you conceive a layout to conserve them? Never sacrifice a tree if you can help it.

How is the ground? Can it drain? Is it too steep to plant? Can you construct with ease or connect indoors with some level spot outdoors?

How is the soil; Is it good enough to nourish and support roots; Will it be eroded by your building operations and grading?

Are there any existing neighbors? Or where most likely may they build in the future? Neighborliness will be best preserved if you can arrange your building to keep your privacy and let them keep theirs. Sometimes you may wish to be alone, undisturbed, with the spirits of your place.

Finally, try to understand the character and peculiarities of your site. Heighten and intensify what it may offer, never work against its inner grain and fiber. You will pay dearly for any such offense, though you may never clearly note what wasting leak your happiness has sprung. (Neutra, 19), p. 62.

The nature of the climate and its attendant ills were also environmental factors which must be considered in the over-all analysis. These are factors such as the direction of summer and winter winds, the amount of rainfall and snowfall, and the solar orientation in regard to the geographic location.

Whatever the approach we may use, let us make the most of the climate; let us learn how to live with the climate, not in opposition of it. Let us realize that there are not only many different climates on this continent but also so many in every state and province, in every country and parish, in every city and town, in every village and hamlet, in every garden, and indeed, right up to every front door. Let us make sure that the climate at our door knocks softly. (Aronin, 1), p. 281.

In the first problem relating to man and environment the approach was that of defining simple spaces according to the

desired physical zoning and psychological considerations (Plate VI). Environmental factors were taken into consideration by the use of an actual site.

The plan is the paper projection of actual and proposed space relations on the site, at the handy scale of the drawing board. Working in plan without detailed experience of the site or allowance for adaptation and improvisation during installation is the sterile conclusion of the mechanical and arbitrary Beaux Arts approach. (Eckbo, 5), p. 72.

The actual site was also used so that all spaces developed in the presentation of the design could be translated in terms of their actual dimensions.

The interpretation of various textures, and the analysis of line and mass had also become real problems.

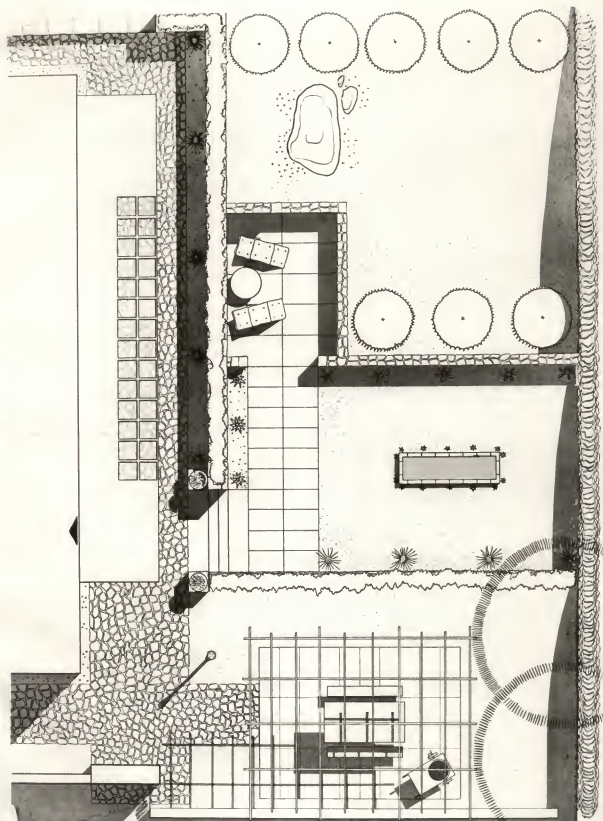
We begin our landscape problem with the analysis of program and site, architecture and people; we project divisions and relations of the land and the space above it, we refine, develop, and perfect these relationships persistently, systematically, and intuitively; very early in the process we begin to think of the relation of materials to the spatial relations we are developing; as we refine the spatial relations we refine the materials concepts, so that the final design drawings are conceptions of the use of materials as well as of the organization of space. In the plan it is a question of the general relations in the controlling over-all three dimensional pattern which unifies the specific garden or landscape elements into a larger whole. (Eckbo, 5), p. 71.

The scope of the problem was limited so that a knowledge of construction and its related spaces and forms were not necessary. It was believed these factors to be too complex and should only

EXPLANATION OF PLATE VI

" A Small Garden and Shelter" --The analysis of simple exterior space relationships, the requirements of man, and the influence of environment.

PLATE VI



be absorbed after the simple requirements of non-technical planning had been firmly mastered.

Space

The cultivation of a sound spatial analysis and the process of thinking three-dimensionally were considered of paramount importance in shaping creative aptitude.

Complete home planning, with all of its facets, factors, and considerations, must be approached as three-dimensional design, or space organization. (Eckbo, 6), p. 48.

Space experience is not everyone's endowment. By practice and suitable exercises, this capacity is developed.

.....Vision is primarily a device of orientation; a means to measure and organize spatial events. The mastery of nature is intimately connected with the mastery of space; this is visual orientation. Each new visual environment demands a reorientation, a new way of measuring. Seeing spatial relationships on a flat land is a different experience from seeing them in a mountainous region, where one form intercepts the other. (Kepes, 13), pp. 13-14.

This experience was developed by the use of a "planning board" on which spaces were organized and interpreted by the play of planes of various textures, colors, and materials (Plate VII). The relationships between indoor spaces, outdoor spaces, and indoor-outdoor spaces were evaluated in relation to their size, proportion, shape, and enclosing elements.

In architecture today there is a preference for transparency, achieved through large areas of glass and through undercutting and opening parts of the building. This transparency, aims at producing the illusion of a floating continuity of space. The buildings seem to hover, space seems to move in and out. Sections of the infinite outdoor space become part of an architectural space composition which does not stop at the enclosing walls, as in past periods, but is carried beyond the building into its surroundings. (Gropius 11), p. 36.

The procedure of spatial analysis was one in which the form and structure were all interpreted as enclosing elements of organized space.

Form and space are inseparable because space is defined or modeled by the forms enclosing it. (Faulkner, 8), p. 131.

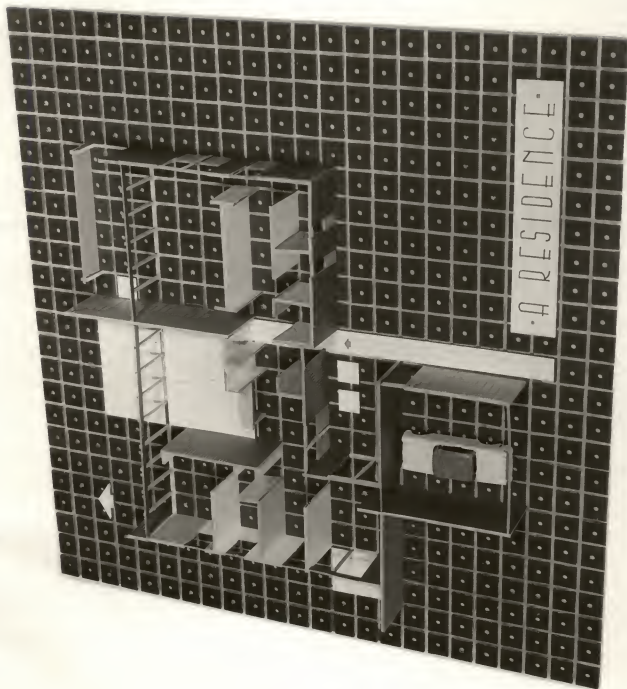
The object of building was the enclosure of space; and the process of building was simply the definition of space. Spatial development was based upon the assumption that though we may overlook it, space affects and can control our spirit. A large part of the pleasure we obtain from architecture--pleasure which seems unaccountable, or for which we do not trouble to account--springs in reality from space.

The previous investigations of "Man and His Environment", were related to spatial organization in order to achieve a completely comprehensive approach to architectural planning. Advanced technology and structural concepts have given us the means to interpret the contemporary needs of man in terms

EXPLANATION OF PLATE VII

The "Planning Board" used for studying interior
and exterior space relationships.

PLATE VII



of dynamic spaces, and the purpose of spatial investigation was predicated toward an increase in knowledge and understanding of space in order to solve its many perplexing problems in organization.

The possibilities offered by the new construction and by the free plan allow the inside of the building to be opened to the penetration of outside space. In modern composition mass is replaced by the conception of volume. The traditional wall pierced with windows and doors almost belongs to a past period: the transparent or opaque screen, fitted between floor and ceiling is taking its place. A structural brick wall used today in small architectural problems is often employed with the same feeling of screen principle. The predominant construction of a given period influences the shapes adopted by one less typical for the same time, and thus contemporary brick architecture follows the aesthetic characteristics for the column and screen principle. (Nowicki, 22), p. 407.

The determinant elements of spatial sensation were found to be:

I. The relations between two elements.

A. The enclosing Agent

1. People

2. Walls

a. Texture

b. Color and Pattern

c. Density

d. Scale

3. Natural Growth

a. Texture

b. Color and Pattern

- c. Density
- d. Scale
- B. The enclosed Space
 - 1. Size of enclosed Space
 - 2. Degree of Enclosure
 - 3. The Shape of the enclosed Space
- C. The relation of enclosed spaces to one another
- D. The relation of the enclosed person to the enclosed space
- E. Automatic registration of successive images
- F. Effect of memorized analogies

The representation of actual spaces must always be preceded by an analysis of the design in relation to its actual scale whenever possible. For instance, when a space is expressed, no matter what the scale, the conception must be through the association with the actual dimensions of the space involved.

The scope of spatial analysis included the investigation of exterior spaces. When buildings were considered in relation to each other, it was found that these buildings, first considered separately and by themselves, formed parts of an enclosure or spatial order when combined with other buildings. This was evidenced in urban design where each building is considered in relation to other buildings and to the open spaces left between them. It was found that buildings may fulfill

a dual purpose; while inside them enclosed spaces are provided for certain functions, their outsides form part of another equally important order, a civic order for another set of functions.

Architecture is placed in space and at the same time encloses space. Therefore a double problem arises--the handling of outer space, as well as the inner space. These two kinds of space can be unrelated to each other, or they can, by various means be united. The outer space can merge with the inner, the inner space with the outer. Or both can flow into one space. (Hilberseimer 12), p. 41.

The previous exercises in compositions of masses proved invaluable as preliminary exercise for the development of exterior spaces and relationships between various forms and sizes of buildings (Plate VIII).

Space is the position relation of bodies.
A definition of space which may at least be taken as a point of departure is found in physics--"space is the relation between the position of bodies".

Therefore: Spatial creation is the creation of relationships of position of bodies (volumes). (Moholy-Nagy, 16), p. 57.

Form and Structure

The concluding exercise was an introductory investigation of form and structure. The interpretation of form as investigated, applied to the disposition or arrangement of parts which gave a peculiar aspect or appearance to a building. This arrangement, whether internal or external, in turn gave unity

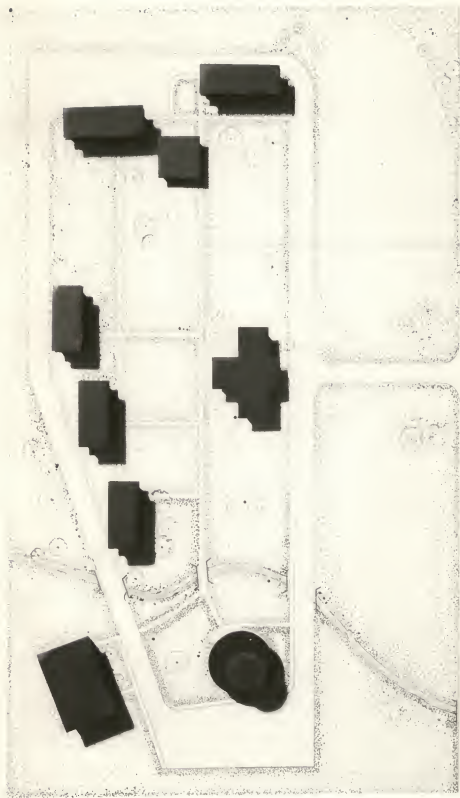
EXPLANATION OF PLATE VIII

The site planning for "A Small Junior College" --

A study of the complex organization of exterior spaces
and volumes, and the physical and psychological needs of

MAN.

PLATE VIII



A JUNIOR COLLEGE

to the whole. Structure, as interpreted, pertained to the interrelation of parts as dominated by the general character of the whole. It was found that the physical and psychological requirements, when analyzed, set certain demands upon the spaces and the means of identifying or shaping them.

The architect, by his arrangement of forms, realizes an order which is a pure creation of his spirit; by forms and shapes he affects our senses to an acute degree and provokes plastic emotions; by the relationships which he creates he wakes profound echoes in us, he gives us the measure of an order which we feel to be in accordance with that of our world, he determines the various movements of our heart and of our understanding; it is then that we experience the sense of beauty. (Le Corbusier, 14), p. 7.

These elements, when combined were classified as the functional requirements of form. These functional requirements, when related to the shaping of spaces became one of the principal determinants of form. This analysis; when comprehended, led to the discovery that if all facets were properly interpreted, then the form expressed the function.

.....In terms of function the rule must be "to plant a building firmly on the ground", that is, to adapt its size and form to the terrain (site); "the monumental character of a building has reference to its site--to its adaptation in size and form to that site. It has reference also to the external expression of the inward functions of the building." The most advanced modern architects could aspire to no higher ideal. (Greenough, 10), p. xv.

The evolution of form, however, was not determined by function alone, but also by its fitness to materials and

techniques. It was found that the ultimate physical development of form could only be achieved through a sound knowledge of construction principles, building materials, and structural ingenuity. Since the technical knowledge required for the organization of all component parts of form must be extremely extensive, the approach was one in which the form as determined by the function, the materials, and the techniques; was relatively simple. The function was simply that of providing shelter for a small group of individuals. The materials were native to the region, and the techniques were those utilizing a small number of hand tools.

The problem of overcoming the limited technical knowledge required for calculating structural forces was handled by the introduction and an explanation of such forces as tension, compression, torque, and shear. The evaluation of structural forces was solved by the process of intuitive reasoning.

The problems of graphically representing the form as well as the spaces and existing entourage became one in which the evaluation of line, texture, and mass was of utmost importance (Plate IX).

CONCLUSION

The entire investigation was predicated by the postulation that the design capabilities of the architect are based upon his creative aptitude and his ability to express his ideas graphically so they may be easily interpreted by others.

EXPLANATION OF PLATE IX

"A Boy Scout Camp"--A complex organization of space and volume, physical and psychological requirements, environmental influences, and the development of form and structure.

PLATE IX



It is believed the best approach for developing these capabilities is one which recognizes the correlation between the thought process and the graphic expression of its results. The fundamentals of basic design can be taught in relation to their value in aesthetic interpretation and graphic representation. The basic factors of design--line, plane, mass, pattern, form and surface quality were irreputably found to be invaluable elements of architectural design. They in turn, were necessary agents for the graphical expression of the intended result.

The synthesis of architectural expression does not simply lie in the presentation of a "pretty picture", but rather in the coherent presentation of well organized visual spaces, forms, textures, and planes--the elements of architecture. This organization must be based upon a sound evaluation of the abstract qualities of basic design and the psychological and physical aspects of architectural design.

.....Modern design is not another "manner" to add to our bag of stylistic tricks; it is not a new kind of exterior decoration to be picked up by reading a couple of magazine articles of an evening, or taking a short brush-up course during the dull summer season; it is not composed of rackets, chevrons, zigs, zags, squirms, wiggles, or other juke-box tricks; it is not a new kind of double talk to be lifted from the shopwindow designer's jargon; it is not a matter of bending axes into spirals, or of rejuvenating nature with a new skirt-length or a new set of glands. Modern design is serious work. It begins with the rejection of pre-conceived academic systems of form as being stale and irrelevant, and proceeds with a re-analysis of basic elements and problems,

and an attempt to derive from that analysis principles of organization which are truly relevant and not superficial or shallow. Specific forms produced by specific designers who are endeavoring to carry on such serious re-analysis are experimental and in process of development, and are not intended as material for a new academic system and a new series of measured drawings. (Eckbo, 5), p. 47.

Style in architecture must arise out of conditions of climate, the land, and the customs and conditions of the people who are served by it. (De Zurko, 4), p. 57.

The process of organization must be one which gradually develops an appreciative attitude toward all of the component factors which are the necessities for good design. These, in turn, fabricated into an organic whole.

First came the general philosophy of the thing All artistic creation has its own philosophy. It is the first condition of creation. However, some would smile and say, the result of it.

Second, there was the general purpose of the whole to consider in each part: A matter of reasoned arrangements. This arrangement must be made with a sense of the yet-unborn whole in the mind, to be blocked out as appropriated to concrete masses cast in wooden boxes. Holding all this diversity together in a preconceived direction is really no light matter but is the condition of creation. Imagination conceives here the PLAN suitable to the material and the purpose of the whole, seeing the probably possible form clearer all the time.

Imagination reigns supreme, until now the form the whole will naturally take must be seen.

But if all this preliminary planning has been well conceived that question in the main is settled. This matter of style is organic now. (Wright, 28), p. 31.

It should be recognized that this was only a basic approach to the elements-graphics process, and was not by any means intended as being one capable of producing individuals ready to solve the many problems involved in architectural design. The ability to cope with and conquer complex architectural problems must be as a result of further education.

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AN INVESTIGATION OF PROCEDURE AND TECHNIQUES
INVOLVED IN GRAPHIC REPRESENTATION

by

JACK CLYDE DURGAN

B. Arch., Oklahoma State University, 1951

AN ABSTRACT OF A THESIS

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The architect must rely upon graphical expression as his principal method for the transmission of ideas. However, success or failure of the completed project is not only dependent upon the architect's presentation capabilities, but also upon his creative aptitude. There is a related interdependence between the two which should be recognized.

The two-fold approach to architectural design entails a process through which the thought progression and the techniques for its transference become so closely related that one is almost synonymous with the other. Through a thorough analysis of the factors relating to abstract composition, a knowledge of relationships is gained. When this is coupled with the three-dimensional requirements related to the needs of "man and his environment", and properly translated graphically, the resultant work becomes true architectural expression. The beginning architect must be conscious from the very first of the three-dimensional aspects and ultimate scale of the actual building when designing. He must be taught to think in terms of relative sizes, relative spaces, and relative textures.

The procedures for the two-fold development of the architectural designer began with the analysis of simple abstract compositions. Perceptual capacities were developed by this method, and techniques for graphical expression were also disciplined. The design symbols (line, plane, form, and surface quality) were studied and analyzed in terms of their inherent qualities.

The first compositional studies involved the study of lines--their inherent characteristics and their possibilities as a design tool. Studies were made analyzing the psychological movement or direction of line in order to understand the resultant application of this phenomenon in relation to architectural design.

The recognition of spatial sensation through the projection of lines and planes into space on a two-dimensional surface enabled the development of an awareness for the three-dimensional aspects involved in architectural design as well as to cultivate an appreciation for the use of line in defining planes, shapes, and masses.

By studying abstract compositions relating to textures, a sense or "feeling" for the nature of materials used in the production of architecture, and the perfection of a technique for the graphical representation of various materials was developed. Spatial modulation was analyzed through the use of textures and patterns.

Relationships were established by relating shapes and masses in two dimensional compositions. It was observed that certain shapes have inherent characteristics which gave static or dynamic quality to the composition. Thus, through the juxtaposition of shapes and masses, relationships were achieved through consideration of their proximity, their size, and their shape. This proved invaluable in the analysis of symmetrical and asymmetrical balance.

To supplement abstract composition and aid in the development of a means of expression, the elements of entourage were introduced. These are the elements which help give architectural expression its scale and realistic qualities. The further analysis of line, plane, form, and surface quality in the representation of these elements (trees, people, cars, etc.) gave added meaning to the importance of sound graphical expression.

With the fundamentals of abstract composition well in mind, further studies involved the recognition of the influence of "man" in architectural design. This entailed an investigation of the physiology of "man" in the determination of architectural volumes. It developed a keen awareness for providing architecture which will serve both man's physical and psychological needs.

Following studies pertaining to "man" were exercises involving the environmental influences which help dictate the positioning of architectural spaces. This was a reaffirmation of the postulation that architectural planning must begin with the site ---the slope of the land; size of the property; type, size and location of existing natural growth; etc. Along with the environmental factors, climatic conditions also became real factors influencing architectural design.

In the analysis of architecture, an understanding of space was found to be of paramount importance. It was readily recognized that architecture begins and ends with spatial organization. Study and analysis of both interior and exterior spaces

and the methods by which they may be modulated and articulated were given considerable emphasis.

The concluding investigation consisted of an analysis of the component functional and physical requirements for the development of form and the analysis of basic structural forces. Form applied to the arrangement of parts which gave a peculiar aspect or appearance to a building, while structure was conceived as pertaining to the interrelation of parts as dominated by the general character of the whole.

In the final analysis, it was concluded that graphic representation, the "tool" of thought transference, should become an integral part of the design process. The student should not think of graphic expression and design procedure as being entities within themselves, but as a correlated whole so related that every symbol used has not only a representational intention, but also a well conceived design purpose.